tion of excellent specimens of school work done in the Allan Glen's Institution of Glasgow, in which the object of a two years' technical course is to prepare boys to learn trades whose mastery implies a considerable amount of scientific knowledge. University College, Nottingham, exhibits some work done in the recently established technical school attached to it, and the Engineering Department of University College, London, illustrates its work mainly by photographs and plans. The nearest approach to the handicraft school teaching as practised on the Continent, is to be found in the admirable technical work of the Central Higher School of the Sheffield School Board, in which an attempt is made to provide the proper connection between the theoretical instruction in the class-room and the practical instruction in the workshop. The Manchester Technical School, the Oldham School of Science and Art, the Clerkenwell Technical Drawing School, and the School of Art Wood carving all show praiseworthy results of technical training. Attention may here be called too to the admirable specimens of work done in the four trades-departments of the National Industrial Home for Crippled Boys ; the pupils vary in age from twelve to eighteen, and having chosen a trade on entering the school, follow it for three years.

Among the results of the work of individual exhibitors, the exhibit of Mr. Robins calls for special notice, consisting as it does of a series of drawings illustrative of the general arrangements and fittings required for applied science educational buildings ; these are so placed that comparisons are readily made between the arrangements adopted in various noted colleges, &c. Mr. Millis shows some excellent results of instruction in trades classes, specially models in wood and metal-plate work. Mr. James Rigg exhibits more than a hundred mechanical models specially arranged for instruction in four or five of the subjects in which the Science and Art Department examines pupils, and a smaller collection of the same kind is shown by Messrs. Gilkes and Co. Lathes of different patterns, and other mechanical tools and apparatus, are exhibited by Messrs. Holtzapffel and Co., Messrs. Melhuish and Sons, Mr. Syer, Mr. Evans, and others.

In neither of these articles has any reference been made to the appliances for elementary art instruction, nor to the special methods and apparatus used in educating the blind, and the deaf and dumb, all of which, however, are very fully illustrated. The seven classes of exhibits which come under "Group IV.—The School" (to quote the official phraseology) are also unnoticed. These comprise such important subjects as everything relating to the structural arrangements of school buildings, school kitchens, sanatoria, and infirmaries, and lastly, though by no means least in importance, the gymnastic and other apparatus for physical training in schools. Enough however has, we hope, been said to give some idea of the vast scope of this exhibition of educational appliances, and to justify the assertion made at the beginning of the first article, that probably no such extensive and valuable a collection of school appliances, methods, and results has ever been brought together before. Such an opportunity for study is not likely to occur again for some years, and we conclude by reiterating an earnest hope that it will not be lost by those most vitally interested in it.

WM. LANT CARPENTER

CHEMICAL RESEARCH IN ENGLAND

THE address of Dr. Perkin, F.R.S., to the Chemical Society at its anniversary meeting contains some sadly true statements respecting the state or rather the absolute want of state of research in chemical science in this country. After drawing attention to some interesting points in the work done during the past year, Dr. Perkin goes on in the first place to refer to the very small number of original papers contributed to the Society during the past year (a point to which attention was called in these columns a few months ago), and then compares foreign sources of research work and the probable causes of this disparity. But this portion of the address will speak better for itself than in a mere abstract, and the facts therein stated demand the most serious attention of the authorities at our seats of learning.

Last year, Dr. Perkin went on to say, my predecessor, in his address, referred to the increasing number of chemical laboratories in the United Kingdom and the greater facilities which are now afforded for the prosecution of research. After considering the number of papers which have been read before this Society during the past few years, it appeared to me that it might be useful to make some remarks as to the influence these greater facilities have had on the development of chemical science.

The first thing that attracts attention is the startling and anomalous fact that the number of papers read before the Society (and I think this may be taken as a good criterion, especially as but few have been brought before the Royal Society) is declining year by year. The largest number we ever had was in the session 1880–81, when there were 113 communications brought before us ; but in 1881–82 they declined to 87, in 1882–83 to 70, and this last session to the lamentably low number of 67, or about the number we had nine years ago. And this, not only with increased laboratory accommodation, but also with the assistance offered to investigators by our Research Fund and the Government Grant. This state of things causes us to look around and see where research *is* and where it *is not* being carried on in the United Kingdom.

If we look to the laboratories of our Universities, from many of these we never hear of a research emanating, and from the rest, taken as a whole, we get but driblets at intervals. How different from the German Universities, from which there is such an incessant flow of work !

If we turn to the other laboratories connected with our colleges, hospitals, &c., with how few exceptions do we find any appreciable amount of work being carried on for the extension of the boundaries of our science ; in fact, speaking in a general way, the work of our laboratories consists mainly in the students carrying out the ordinary course of qualitative and quantitative analysis, and attending one or two courses of lectures.

It is scarcely necessary to say that this is not sufficient, however well taught, to make a student a chemist ; it is but a preliminary part of the training, which, being carried on as it usually is, by tables, and carefully laid down directions, gives but little scope for independent thought and action. The subsequent prosecution of scientific research, under proper supervision, however, is quite another thing, and calls out all the faculties of the student, requiring, as it does, independent thought and independent methods of working, and, moreover, gives him an insight and vivid interest in his science that nothing else will do. The preparation of chemical products, before the commencement of research, is no doubt also a very useful training if sufficiently diversified ; but research is the most important of all.

The degree of Doctor of Philosophy has undoubtedly done a good deal to further chemistry in Germany, necessitating, as it does, the prosecution of original work, and now that degrees are so much thought of in this country (though why a chemist with one of our ordinary University degrees should be preferred to one who has fully given his mind to his science, and therefore has not got such a degree, it is difficult to understand), it is believed that if something analogous to the Ph.D. could be inaugurated in this country, it would help to further chemical science here also. A step in this direction has been taken at the Owens College, Manchester, but hitherto the degree has not found favour with students. It is not surprising, however, while there are so many different degrees not requiring original work as a *sine quâ non*, that such a degree should not be sought after. This difficulty, however, might be overcome by modifying the requirements for the present degrees, and requiring that original research should be substituted for book knowledge. At the London University original work is recognised, but not required.

The past neglect of research will, it is to be feared, have a more lasting influence on the progress of chemistry in this country than may appear at first sight, and in this way. Those who have been students in laboratories where the importance of

this kind of work is not recognised, advance in their positions, becoming assistant demonstrators, &c., and eventually professors, and as they have not learnt to practically realise the value of research by being in the habit of conducting it themselves, or of seeing others do so, when they become professors they will naturally not encourage students to undertake it in their laboratories, and it is to be feared that we are already suffering in this way, and that this is one of the causes why the new laboratories which have been opened are doing so little to add to our store of fresh knowledge.

It is said that students cannot be induced to stay longer than is necessary to go through the ordinary course of qualitative and quantitative analysis, and can this be wondered at when they do not see anything else going on of sufficient interest to make them feel it would be a great advantage for them to do so? Would it be the case if higher work were being enthusiastically carried on? The fact that many of our students are found to leave this country and go to Germany, where research is carried on with so much zeal, I think gives an answer to this question.

In all chemical laboratories there are without doubt different classes of students: some who have no right to be there, having no care for science; those who have not sufficient capacity to proceed with its study beyond an elementary stage; and those who are capable of becoming efficient chemists. Of course it would be but waste of time to attempt to make the first two classes remain and engage in research. It is to be feared, however, that some are not unfrequently thought to belong to the second class who really, if sufficiently interested in their science by the example of others, would be found to be possessed of no mean ability. When a young man is made to realise that he may be the discoverer of new facts, or does discover new facts, he gets a new impulse, which alters the whole current of his thoughts and actions.

There can be no doubt that when a professor, his assistants, and advanced pupils are enthusiastically engaged with research, their influence is found to act even on beginners, who, if they possess any scientific spirit at all, will realise that the ordinary course of analysis is but a preliminary thing, and will thus be induced to use their best energies to master it that they also may try their hand at original work.

That this condition of things is calculated to fill laboratories with students is seen from the fact that on the Continent, where the greatest scientific activity prevails, the laboratories are the most crowded, and this is the kind of activity we want in this country, where our students pre-eminently possess all the faculties for original work, but as they are not cultivated these are not developed.

There is also another class of students who study chemistry, but the fruit of their study is so extremely small, that it is difficult to realise that it possesses any practical value. I refer to medical students; yet there are good teachers and good laboratories employed in the work, in fact a very large amount of valuable power is used for it; but it seems almost like the employment of a large amount of power to raise a weight to a certain distance and then let it fall again, and year after year to continue the same thing, never raising it sufficiently high that it may be placed in a useful position. The present condition of things cannot but be disheartening both to students and to teachers. Medical students have so much to learn that it it is sad they should have to waste their time in studying chemistry in the way they do. If there is any value in chemical products as curative agents, if there is any value in physiological chemistry, or any importance in toxicology, surely medical students should have a sound knowledge of chemical science, and not simply learn to detect an acid and a base in a mixture, an operation which is of no value except as an intermediate exercise, to be followed by more advanced work.

The only cure for the evil appears to be either that their term of study should be lengthened, or that other subjects which are of less importance should be withdrawn from the curriculum, so as to enable them to work at this science sufficiently. Unfortunately medical men have as a rule acquired so imperfect a knowledge of chemistry themselves that they have found it to be of little value, and therefore do not sufficiently see how important its proper study would be to students. It is evidently high time that some steps were taken to economise the present waste of time and power, and that we should hear of some good work proceeding from the numerous, and in many cases well-appointed, chemical laboratories connected with our hospitals.

Of late years much attention has been given to the subject of technical or applied chemistry, and it is to be hoped that this movement will be so judiciously carried on that much will be done for perfecting and developing the chemical manufactures in this country; but it appears that there is an idea in the public mind that there are two kinds of chemistry in existence, one suitable for the manufacturer, and the other suitable for the scientific man; and unless this idea can be successfully eradicated, it is to be feared that much of the value of this movement will be lost, and we shall be left in the position of followers instead of leaders; copyists of what others are doing, instead of being originators of new processes and industries.

In the present state of things students who are to be manufacturers are supposed to know enough chemistry when they have acquired a knowledge of ordinary analytical methods, and the result is that we have but very few efficient chemists in our works. On the Continent, however, we find a very different state of things: first of all, in their chemical works they usually have a much larger staff of chemists than we do, and secondly, their chemists are efficient men.

The chemists preferred in Germany are those who have had a thorough training, and taken their degree of Doctor of Philosophy, and shown their power as chemists by conducting original research, and in many cases have been for some time assistants to the professors in their research laboratories. Those from the Polytechnics are not so much valued, except in relation to their knowledge of engineering, mechanics, &c.

What do we see as the result of the employment of high-class chemists in Germany? First, we notice that chemical industries are developing and increasing there more than in any other country; and secondly, that the manufacturers are able to make their products in a very economical manner, and as a consequence supply them at a low price. Men who have studied chemistry sufficiently to do analysis and look after existing processes which are well known are certainly useful in their way; but we want more than this; we want men who have had their minds so trained by carrying on research that they may be imbued with a spirit of investigation, and be able to improve or entirely change processes in use, and to keep up their knowledge of chemical science, so as to be able to grasp the importance of new scientific facts, and make them subservient to the industries they are engaged in.

The chemists from the German Universities, when entering chemical works, naturally have but little knowledge of technical processes. This they have to acquire, but unfortunately they then only are likely to see those operations which are carried on in the particular industry with which they become connected. Those who study in the Polytechnics have a certain advantage in this particular, inasmuch as they can become acquainted with processes carried on in a variety of manufactures; and what is wanted nowadays is something like what would result from a fusion of the work of the Universities and the Polytechnics, *i.e.* scientific training similar to that in the former, with a general knowledge of engineering, mechanics, &c., and the methods adopted in carrying on processes on the large scale, this latter not being confined to one industry only, but also to industries in general, so that great breadth of knowledge may be acquired. With men so trained we might expect to see our chemical industries flourish, and keep at least abreast of those on the Continent.

It is to be hoped that some such standard of training will be undertaken at the Central Institute of the City and Guilds of London. It would be a sad thing to find the munificence of the City Companies resulting only in perpetuating the present kind of imperfectly trained chemists, who are incapable of advancing the chemical industries of this country, so that our manufacturers not unfrequently find it necessary to send to the Continent for more competent men.

In this retrospect of the work which is being carried on in relation to chemistry, it may be thought by some that an undue weight has been given to that which is going on in Germany, and too little to that which is being carried on in this country; but I think if any one will impartially compare one with the other, this will not be found to be the case. Science, however, has no nationality, and as chemists we cannot but be thankful that it is being actively studied, whether abroad or in our own country; but we must feel that it is our duty to do our part, especially when we see, from the work which has been and is being done in this country, that nationally we have the characteristics which qualify us to take a prominent position in work of this nature.

But from the point of view of our national progress we are bound to be active workers in this field of science. There is no doubt we do not hold the position we did as chemical manufacturers, and unless our chemical industries keep pace with chemical discovery fully as well as they do on the Continent, our position must further decline, and moreover, unless we make chemical discoveries ourselves, we must wait until we hear of the discoveries of others, which will mean, in cases where they are susceptible of practical application, that we are placed at a great disadvantage.

The bearing which the progress of chemistry in this country has upon this the oldest Chemical Society in existence is so obvious that it is superfluous to make any observation on the subject, except to express the hope that it will continue to be active, and found doing its part for the advancement of our science, and as a consequence be an important factor in the welfare of our country.

ON THE EVOLUTION OF FORMS OF ORNAMENT[1]

THE statement that modern culture can be understood only through a study of all its stages of development is equally true of its several branches.

Let us assume that decorative art is one of these. It contains in itself, like language and writing, elements of ancient and even of prehistoric forms, but it must, like these other expressions of culture, which are for ever undergoing changes, adapt itself to the new demands which are made upon it, not excepting the very arbitrary ones of fashion; and it is owing to this cause that, sometimes even in the early stages of its development, little or nothing of its original form is recognisable.

Investigations the object of which is to clear up this process of development as far as possible are likely to be of some service: a person is more likely to recognise the beauties in the details of ornamental works of art if he has an acquaintance with the leading styles, and the artist who is freed from the bondage of absolute tradition will be put into a better position to discriminate between accidental and arbitrary and organic and legitimate forms, and will thus have his work in the creation of new ones made more easy for him.

Hence I venture to claim some measure of indulgence in communicating the results of the following somewhat theoretical investigations, as they are not altogether without a practical importance. I must ask the reader to follow me into a modern drawing-room, not into one that will dazzle us with its cold elegance, but into one whose comfort invites us to remain in it.

The simple stucco ceiling presents a central rosette, which passes over by light conventional floral forms into the general pattern of the ceiling. The frieze also, which is made of the same material, presents a similar but somewhat more compact floral pattern as its chief motive. Neither of these, though they belong to an old and never extinct species, has as yet attained the dignity of a special name.

The walls are covered with a paper the ornamentation of which is based upon the designs of the splendid textile fabrics of the Middle Ages, and represents a floral pattern of spirals and climbing plants, and bears evident traces of the influence of Eastern culture. It is called a pomegranate or pine-apple pattern, although in this case neither pomegranates nor pine-apples are recognisable.

Similarly with respect to the pattern of the coverings of the chairs and sofas and of the stove-tiles; these, however, show the influence of Eastern culture more distinctly.

The carpet also, which is not a true Oriental one, fails to rivet the attention, but gives a quiet satisfaction to the eye which, as it were, casually glances over it, by its simple pattern, which is derived from Persian-Indian archetypes (Cashmere pattern, Indian palmettas), and which is ever rhythmically repeating itself (see Fig. 1).

The floral pattern on the dressing-gown of the master of the house, as well as on the light woollen shawl that is thrown round the shoulders of his wife, and even the brightly coloured glass knickknacks on the mantel-piece, manufactured in Silesia after the Indian patterns of the Reuleaux collection, again show the same motive; in the one case, in the more geometrical linear arrangement, in the other, in the more freely entwined spirals.

Now you will perhaps permit me to denominate these three groups of patterns that occur in our new home fabrics as modern patterns. Whether we shall in the next season be able, in the widest sense of the word, to call these patterns modern naturally depends on the ruling fashion of the day, which of course cannot be calculated upon (Fig. 2).

I beg to be allowed to postpone the nearer definition of the forms that occur in the three groups, which, however,

FIG. 1.

on a closer examination all present a good deal that they have in common. Taking them in a general way, they all show a leaf-form inclosing an inflorescence in the form of an ear, or thistle; or at other times a fruit or a fruit-form. In the same way with the stucco ornaments and the wall-paper pattern.

The Cashmere pattern also essentially consists of a leaf with its apex laterally expanded: it incloses an ear-shaped flower-stem, set with small florets, which in exceptional cases protrude beyond the outline of the leaf; the whole is treated rigorously as an absolute flat ornament, and hence its recognition is rendered somewhat more difficult. The blank expansion of the leaf is not quite unrelieved by ornament, but is set off with small points, spots, and blossoms. This will be thought less strange if we reflect on the Eastern representations of animals, in the portrayal of which the flat expanses produced by the muscle-layers are often treated from a purely decorative point of view, which strikes us as an exaggeration of convention.

[1] From a paper by Prof. Jacobsthal in the *Transactions* of the Archæological Society of Berlin.